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SCR-Stacking Structure with High Holding Voltage for IO and Power Clamp

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Abstract : In this paper, we proposed a novel SCR (Silicon Controlled Rectifier) - based ESD (Electrostatic Discharge) protection device for I/O and power clamp. The proposed device has a higher holding voltage characteristic than conventional SCR. These characteristics enable to have latch-up immunity under normal operating conditions as well as superior full chip ESD protection. The proposed device was analyzed to figure out electrical characteristics and tolerance robustness in term of individual design parameters (D1, D2, D3). They are investigated by using the Synopsys TCAD simulator. As a result of simulation, holding voltage increased with different design parameters. The holding voltage of the proposed device changes from 3.3V to 7.9V. Also, N-Stack structure ESD device with the high holding voltage is proposed. In the simulation results, 2-stack has holding voltage of 6.8V and 3-stack has holding voltage of 10.5V. The simulation results show that holding voltage of stacking structure can be larger than the operation voltage of high-voltage application.

Keywords : ESD, SCR, holding voltage, stack, power clamp
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